

REMARKS/ARGUMENTS

This Amendment responds to the issues presented in the Official Action of June 18, 2004 and accompanies a Request for Continued Examination. Claims 1-7 remain active in the application subsequent to entry of this Amendment.

The claims are amended in order to more particularly point out and distinctly claim that which applicants regard as their invention and to include significant features which further distinguishes the claims from the applied prior art. More specifically, independent claims 1-3 are amended to define the positive active material for an alkaline storage battery as including nickel hydroxide and β -NiOOH as a main component. This feature is described in paragraphs [0008]-[0009] and serves to distinguish the material manufactured by the method of the present invention from the active material obtained by the procedure described in Ovshinsky, as discussed in more detail in the comments that follow.

In addition, the reducing agent in each of independent claims 1-3 is defined to be consistent with the description of the invention found in paragraph [0047]. Again, this reducing agent differs from the disclosures of the primary reference as explained in more detail below. These two amendments to claims 1-3 make it unnecessary to further characterize the oxidizing step as previously stated in each of these claims, so this passage relating to the oxidizing step is proposed to be deleted.

Claim 7 is amended responding to the examiner's comment in item 2 of the Official Action.

The above amendments to the claims find ample basis in the original description of the invention and these amendments serve to advance prosecution. The reasons why the positive active material of the present invention includes nickel hydroxide and β -NiOOH is described in various passages of the specification, in particular paragraphs [0002]-[0005].

Briefly, the reaction between divalent nickel hydroxide and trivalent nickel oxide is not a complete reversible reaction. Thus, a phenomenon occurs involving suspension of a discharge reaction at a valence oxidation number of 2.2 when nickel oxyhydroxide is converted back to nickel hydroxide during discharge. The negative electrode always has electricity left in it in an amount corresponding to a valence of 0.2. This remaining electricity makes no contribution to battery capacity.

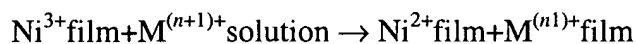
In order to eliminate this remaining electricity at the negative electrode, a nickel oxide having a valence of greater than 2 (higher order nickel hydroxide), which is obtained by chemically oxidizing nickel hydroxide, is used as a positive active material.

As discussed in the Amendment and response of April 14, 2004, the inventors have found that γ -NiOOH, which is difficult to discharge electrochemically, is generated together with β -NiOOH which is easily dischargeable electrochemically in the case of chemically oxidizing nickel hydroxide as a method for producing higher-order nickel hydroxide for the positive pole active material. The produced γ -NiOOH hinders the electroconductivity of the obtained higher-order nickel hydroxide, thereby deteriorating its utilization and decreasing the discharge capacity when an alkali battery is constructed with a positive electrode containing the same.

In order to overcome this drawback, the present inventors have found it effective to carry out a method of excessive chemical oxidation on nickel hydroxide to generate γ -NiOOH which is difficult to discharge electrochemically together with β -NiOOH and then selectively reducing γ -NiOOH in a succeeding reducing step. As fully explained in paragraph [0009], during reduction γ -NiOOH is reduced more easily than β -NiOOH, therefore, the ratio of the content of β -NiOOH is increased.

Turning now to the rejections stated in the Official Action, items 3 and 4, claims 1-3 and 5-7 are rejected as being unpatentable over Ovshinsky in view of Ogasawara while claim 4 is rejected over the same combination of references in combination with JP 11-144723. Both of these rejections are traversed.

Ovshinsky fails to disclose a reduction step using at least one of hydrogen peroxide, hydrazine and hydrogen iodide is used as a reducing agent. Ovshinsky discloses a reduction process starting at column 26, line 53. According to the reduction process of Ovshinsky, trivalent nickel hydroxide (Ni^{3+}) is converted into a state of divalent (Ni^{2+}) that is substantially equivalent to the state of $\text{Ni}(\text{OH})_2$. This reduction process is not intended to exclusively reduce γ -NiOOH which hinders the electroconductivity, but also to reduce β -NiOOH which is necessary to eliminate any remaining electricity at the negative electrode. Ovshinsky gives the equation:



Further, as mentioned in column 26, lines 7-13, the oxidized nickel hydroxide materials are treated with salt solutions. However, this reference fails to show higher-order nickel

hydroxide generated by chemically and partially oxidizing nickel hydroxide, namely, a positive active material including nickel hydroxide and β -NiOOH as stated in applicants' claims.

Ogasawara and JP 11-144723 merely show a positive material for an alkaline storage battery including nickel hydroxide and β -NiOOH. In these references, there is no description relating to a reduction process. These documents suffer from the problem as mentioned in [0004] of the present application. This is, similar to JP parent 2,765,008, γ -NiOOH is present.

As explained above, more of the applied references disclose that γ -NiOOH present in a positive active material is exclusively and selectively reduced and ratio of β -NiOOH is increased.

For the above reasons it is respectfully submitted that claims 1-7 define inventive subject matter. Reconsideration and allowance are solicited.

For completion of the record, counsel is advised that the drawing included with the Amendment and response of April 14, 2004 is incorrect in that the value of γ -NiOOH at 5% in the lower right hand figure should be a range of 2-5%. A further copy of the drawing is attached showing this correction.

Respectfully submitted,

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